

STUDIES IN AUSTRALIAN AQUATIC HEMIPTERA.

No. II.

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FAMILY NOTONECTIDAE.

Plates x-xi and Text fig. 361-373.

THE salient characteristic of the bugs comprising this family is a curious habit of swimming with the venter uppermost, hence their popular name "back-swimmers." The underside of the abdomen has a median, longitudinal keel, with a trough on each side, over which guard hairs close and imprison the air which is utilized during submergence. The back is very convex longitudinally, so that the thorax is relatively deeper than in other aquatic forms. All the tarsi terminate in two claws and are usually two-jointed; in the male of *Anisops* the anterior tarsi have but one joint, and in the *Plea* herein described, both the anterior and intermediate tarsi are monomerous.

Four genera are recorded from Australia, but of these *Anisops* occurs far more commonly than the others, which are represented each by one species only.

Specific Characters. The general size of the head and the comparative width of the dorsal interocular space furnish useful and readily recognized characters in the determination of our species; in this connection the terminology given by Kirkaldy in his "Revision of the Notonectidae, No. 1" (1) is here adopted. The whole of the dorsal interocular surface is called by this author the "notocephalon," the term "vertex" is restricted in its usage to define the apparent anterior margin of the notocephalon, while the distance between the posterior angles of the eyes is aptly termed the "synthlipsis"; Kirkaldy later applied this word to a genus of Australian Mirid bugs. As a rule the inner margins of the large eyes diverge more or less from the base of the head and converge slightly towards the front of the notocephalon, so that the vertex is not actually the widest interocular space.

Colour is in most cases a character of little assistance; the notocephalon is ochraceous or testaceous in dried specimens, and the legs are generally of like colour, with parts of the inner or lower surfaces more or less dark brown to black. The species herein dealt with are structurally sufficiently distinct one from the other to be recognized with comparative ease.

Habits. All are eminently predatory, and our *Enithares* and *Anisops* are

(1) Kirkaldy, Trans. Ent. Soc., 1897, p. 393.

readily maintained in aquaria upon a diet of mosquito larvae. *Anisops* impartially inhabits running or stagnant water, clear or muddy. Examples taken from the River Murray lagoons, and others from Broken Hill, New South Wales, are at times infested with an Hydrachnid parasite, which also occurs on Corixids and water-beetles. Seldom more than one parasite is present on a small bug, whereas several are commonly attached to one beetle; the mite is usually fastened to the pronotum of the bugs, more rarely to an eye.

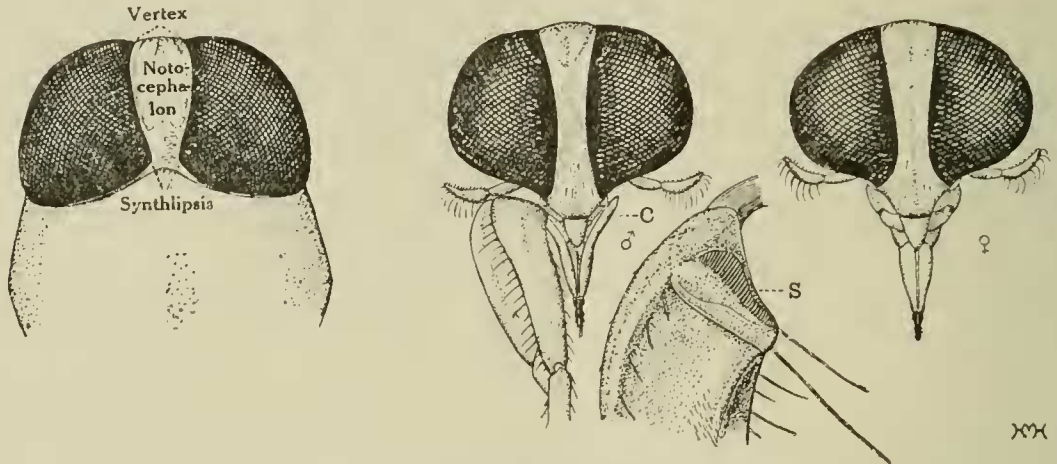


Fig. 361. Nomenclature of dorsal surface of head.

Fig. 362. Head of *Anisops hyperion* as seen from below: (c) chitinous prongs of beak; (s) femoral stridulatory comb.

With a view to determining in some measure the periods at which the various aquatic bugs occur at Adelaide, the ponds bordering the River Torrens were under observation during two successive years. In these situations the backswimmers disappeared at the end of the autumn, but Corixids were taken throughout the year, hibernating females being found amongst masses of *Nitella* and *Chara* in the cold months. On the other hand, in mid-winter many *Anisops*, including four species, were collected at Broken Hill from dams which had been almost or quite dry during the latter part of the summer.

The life history and biology of *Anisops* have not hitherto been recorded: an account of *Anisops hyperion* is given on page 405.

Excepting for the deposition of eggs, *Anisops* very rarely clings to plant stems, its poise in the water being almost perfect: *Enithares* commonly anchors itself to submerged objects (see pl. x, fig. 1), even walking up a plant stem to the surface for a renewal of its air supply.

Reproduction. From an examination of the gonapophyses of the females of six Australian species of *Anisops* it is evident that at least these members of the genus insert their eggs in plant tissues. The endophytic oviposition of *A. hyperion* was proved by actual experiment, and a comparison of the drilling gonapophyses of this species with the others figured on pl. xi will show that, without doubt, all serve a similar purpose.

The ovipositor is very similar in these six species and is of the same character in *Buenoa margaritacea*, the life history and biology of which have been dealt with by Prof. Hungerford.⁽²⁾ This author also figures the drilling gonapophyses of several *Notonectae*, and while these show specific differences it is probable that throughout *Anisops* and *Buenoa* the ovipositor is of common form.

The ova of Notonectids are elongate, and if merely glued to plants are attached by the long axis; the eggs of Corixids are not elongate, are often peg-top shaped, and either pedicellate (as in *Arctocorisa mercenaria* and *Porocorixa eurynome*) or attached at the base to a gelatinous pad (pl. x, fig. 4, 5).

In *Anisops*, considerable dimorphism is exhibited between the sexes. The single-jointed anterior tarsi of the male terminate in curved, flattened and rather blunt claws, and the anterior tibiae are expanded basally on the inner surface to form a spur, on which is situated a stridulatory comb (fig. 362,s). The female differs from the male in having the anterior tarsi two-jointed, with sharper and more slender claws, while the form is usually more robust, the eyes slightly smaller, the notocephalon wider, and the pronotum a little shorter.

In the allied American genus, *Buenoa*, the male has a tibial spur quite similar to that of *Anisops*, and, in some species at least, a femoral area, on which the comb apparently operates. Hungerford describes and figures this apparatus, and mentions that, in addition, there are stridular areas on the face at the base of the beak. In the males of the Australian species of *Anisops* the femoral area is not apparent, but the rostrum is produced on each side to form a chitinous prong; when the anterior legs are folded, the position in which stridulation is effected, the apex of each prong is in juxtaposition with the tibial comb (fig. 362), so that it would seem that sound is produced by the rubbing of the combs on these rostral prongs; the beak is less markedly pronged in the male of *Buenoa*.

The genera at present known from Australia may be distinguished as follows:

- | | |
|---|---------------------------------|
| a. Abdomen with a median, ventral carina; hemelytra overlapping posteriorly; legs dissimilar; eyes large | Sub-family Notonectinae. |
| b. Anterior tarsi of male single-jointed | <i>Anisops</i> . |
| bb. Anterior tarsi of male two-jointed. | |
| c. Pronotum short, with the anterior angles exeavate | <i>Enithares</i> . |
| cc. Pronotum moderately long, the anterior angles not exeavate | <i>Notonecta</i> . |
| aa. Abdomen without median, ventral carina; elytra not overlapping posteriorly; legs similar; eyes rather small | Sub-family Pleinae. <i>Plea</i> |

(2) Hungerford, Bull. Univ. Kansas, xxi, 1919.

SUB-FAMILY NOTONECTINAE.

ANISOPS Spinola.

Anisops Spin., Ess. Hem., 1837, p. 58; Fieb., Rhynchotogr., 1851, p. 57; Stal., Hem. Afr., iii, 1865, p. 191; Kirk., Wien. ent. Zeit., xxiii, 1904, p. 111.

Type, *A. niveus* Fabricius.

This is the predominant Notonectid genus in Australia. The form is slender and the last antennal segment is longer than the penultimate segment, a condition reversed in *Notonecta*. When in the water the bugs appear silvery, with the venter dark.

KEY TO AUSTRALIAN SPECIES OF *ANISOPS*.

- a. Head large, as wide, or almost as wide, as pronotum.
 - b. Form slender; eyes of male almost touching at base of head.
 - c. Male with a cephalic horn *fieberi*.
 - cc. Male without cephalic horn *doris*.
 - bb. Form robust; eyes well separated at base of head.
 - d. Synthlipsis narrower than vertex.
 - e. Pronotum of male long, a little wider than its length *hyperion*.
 - ee. Pronotum short, twice as wide as long *ocularis*.
 - dd. Synthlipsis about same width as vertex *endymion*.
- aa. Head small, distinctly narrower than pronotum.
 - f. Synthlipsis less than half vertex *gratus*.
 - ff. Synthlipsis more than half vertex.
 - g. Posterior margin of pronotum concavely incised; over 10 mm. in length *stali*.
 - gg. Posterior margin of pronotum convex; less than 10 mm. in length *calcaratus*.

I know *A. endymion* only from the original description; Kirkaldy does not mention the comparative width of the head, so that its position in the above key is tentative. If it possesses a small head it should be placed with *A. stali* and *A. calcaratus*, from both of which it differs in the wider synthlipsis.

ANISOPS FIEBERI Kirkaldy.

Anisops fieberi Kirk., Entomologist, 1901, p. 5 & Wien. ent. Zeit., xxiii, 1904, p. 116.

Anisops niveus Fieb., Rhynchotogr., 1851, p. 60 (not Fabr.).

♂ Head, including eyes, about as wide as the pronotum; notocephalon produced outwards and downwards in front of eyes, the anterior margin truncate and slightly concave; interocular space with a narrow swelling on each side, not reaching to base of head and uniting towards front of cephalic projection; synthlipsis about 6 times in the distance between the anterior angles of the eyes; vertex 2 times in an eye. Pronotum 1.7 times wider than long, with a shallow, median depression outlined with some rather indistinct punctures; posterior margin concavely incised; lateral margins almost straight, slightly oblique. Scutellum large, as long as the pronotum, a little longer than wide. Anterior tibiae about 1.8 times as long as tarsi, which are nearly 2.5 times as long as the longest claw. Length, 7 mm.; breadth, 1.7 mm.

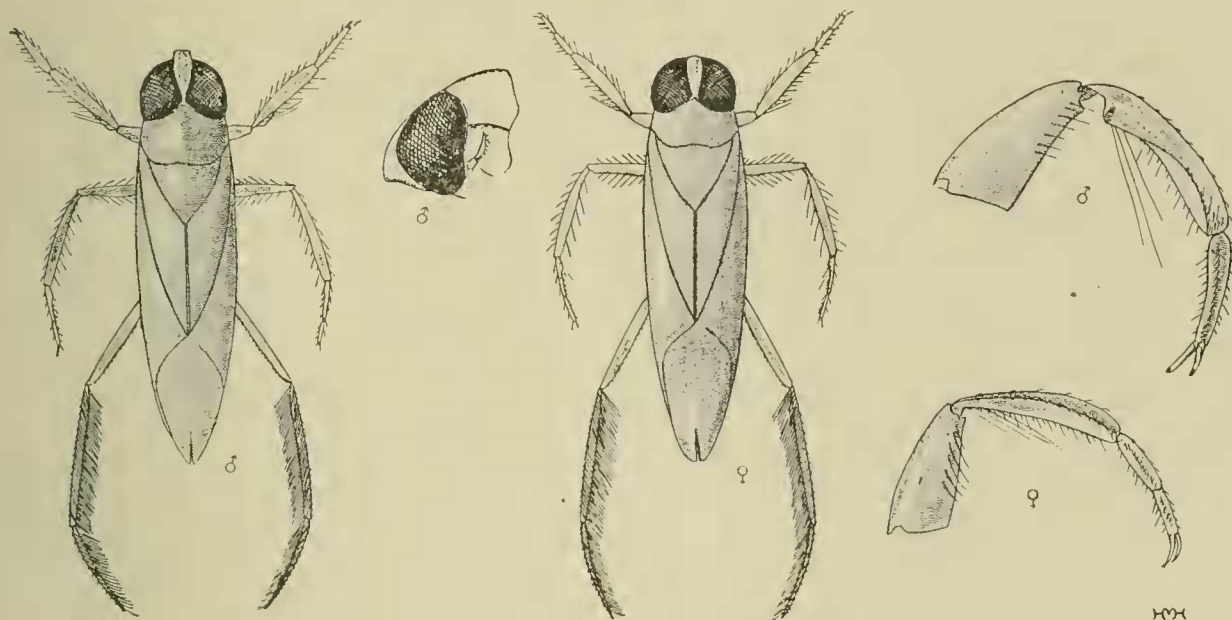


Fig. 363. *Anisops fieberi*.

♀ Vertex not produced in front of eyes; synthlipsis 2.5 to 3 times in vertex, which is 2.3 to 3 times in the width of an eye. Pronotum slightly shorter than in male. Anterior tibiae 1.5 times longer than tarsi, the second segment of which is half as long again as second. Length, 6.5 mm. to 7.2 mm.; width, 1.6 mm. to 1.8 mm.

Hab. Northern Territory: Darwin (G. F. Hill and W. K. Hunt). "Distributed over British India; Celebes" (Kirkaldy); "Ceylon" (Distant).

The colour of the specimens above described has faded to a dingy ochraceous, leaving underside of abdomen, eyes, and swimming hairs black.

ANISOPS DORIS Kirkaldy.

Anisops doris Kirk., Wien. ent. Zeit., xxiii, 1904, p. 112.

♂ Head, including eyes, nearly as wide, or slightly wider than, the pronotum; notocephalon white to yellow or testaceous, with a median groove, on

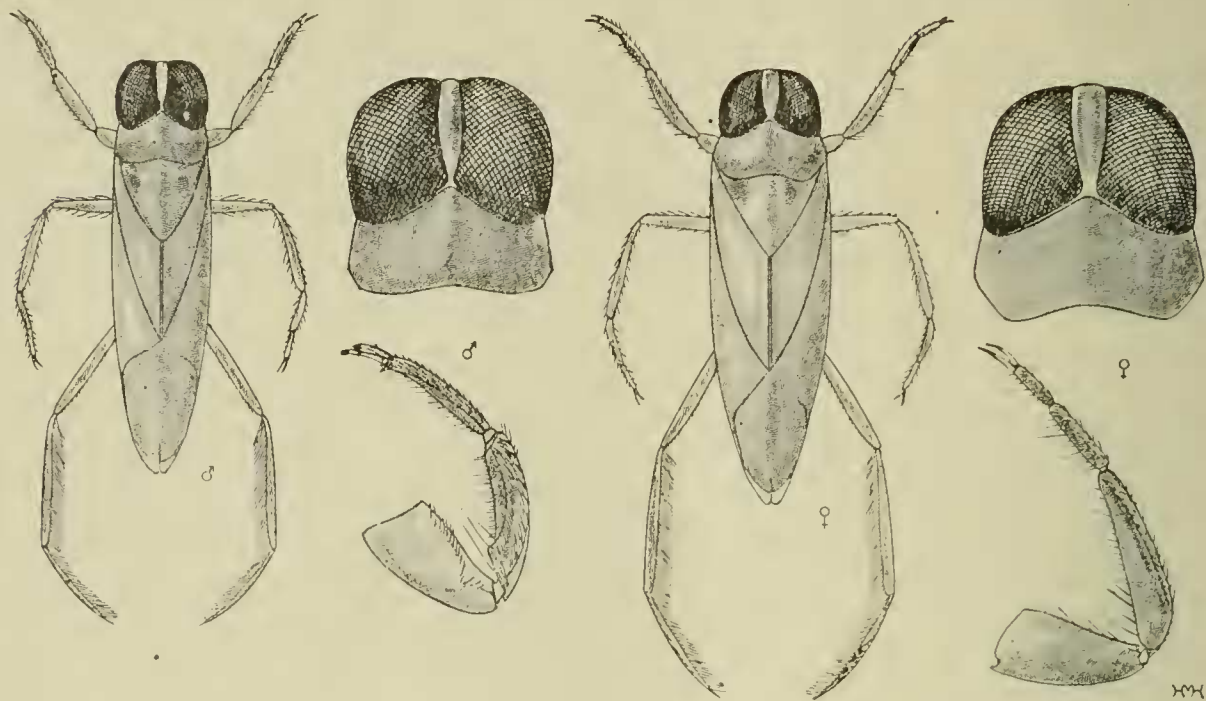


Fig. 364. *Anisops doris*.

each side of which is a narrow swelling, not reaching to base of head; vertex 2·3 to 3·5 in an eye, 3 to 6 times as wide as the narrow synthlipsis; eyes large and prominent, almost touching at base of head. Pronotum pale, smoky or yellow, sometimes darkened posteriorly; about twice as wide as long; superficially punctured; sides parallel or not very divergent. Scutellum pale yellow, bright orange or scarlet, usually with a more or less diffused, large, triangular, black spot on each side; about as wide as long, 1·5 times the length of the pronotum. Metanotum and upper side of abdomen yellowish, black, or testaceous marked with black. Underside black, with carina and lateral edges testaceous. Anterior tibiae 1·4 times the tarsi, which are 2 to 3 times as long as the longest claw. Length, 4·5 mm. to 8 mm.; width, 1·1 mm. to 2 mm. (“8½ mm.—9 mm.” Kirk.).

♀ Form more robust, eyes not so large and always distinctly separated at base of head, and pronotum slightly wider, with the sides more divergent, than in male. Vertex twice, or more than twice, as wide as synthlipsis, which is 5 to 6 times in an eye. Length of second joint of anterior tarsus more than 1·5 times that of first. Length, 5 mm. to 9 mm.; width, 1·28 mm. to 2·2 mm. (“8 mm.—9¼ mm.,” Kirk.).

Hab. South Australia: Adelaide, Murray Bridge, Port Willunga, and Northern Flinders Ranges, 2,000 ft. (H. M. Hale), Lucindale (B. A. Feuerheerdt), Mount Lofty Ranges (J. Formby, J. G. O. Tepper, and H. M. Hale), River Light (Molineaux), Myponga Swamps (A. H. Elston and H. M. Hale), Kangaroo Is. (B. B. Beck); Northern Territory: Alexandria (type locality); Queensland: Gladstone (A. M. Lea), Dalby (Mrs. F. H. Hobler), Karroongooloo Station (H. S. Allnutt); New South Wales: Sydney (W. B. Gurney), Mittagong and Tamworth (A. M. Lea), Broken Hill (F. W. Shepherd); Victoria: Melbourne (Searle), Coromby (J. G. O. Tepper); Tasmania (A. Simson).

The slender form, large eyes and narrow notocephalon are the salient features of this species. The synthlipsis of the male varies in width, but is always exceedingly narrow; the eyes are never actually contiguous basally, although in one instance they are separated by no more than the diameter of an eye facet; the vertex also varies in both sexes. The intermediate tibiae of the several specimens measured by me are relatively shorter than stated by Kirkaldy. A point worthy of note is the variability of size as compared with other Australian members of the genus with similar distribution; large and small specimens have been taken in company in the same localities. During trips to the northern districts of South Australia in 1920 and 1921 a few examples flew to camp lights at night, and others were collected in the clear brackish creeks.

In the spring of 1922 many thousands of backswimmers were congregated near the edges of a small dam in the Mount Lofty Ranges; two species were present in all stages, from egg to adult, most of the imagos having recently completed their metamorphoses. A census showed that *A. doris* occurred along one side of the pool, while *A. hyperion* was confined to the opposite margin.

ANISOPS HYPERION Kirkaldy.

Anisops hyperion Kirk., Wien. ent. Zeit., xvii, 1898, p. 141 & xxiii, 1904, p. 113 (part?).

♂ Head, including eyes, almost as wide as the pronotum; notocephalon ochraceous or testaceous, sometimes suffused at base with orange; with a median longitudinal groove, on each side of which is a swelling, which does not reach to base of head; vertex 1.4 to 1.9 times the synthlipsis, which is 3 to 4.5 times in the width of an eye; tumidities of notocephalon converging on clypeus to form a median carina, on each side of which, and bordering the eye, is a line of punctures. Pronotum pale anteriorly, usually blackish on posterior half, sometimes wholly black or wholly white; length a little less than four-fifths the humeral width; with shallow, scattered punctures and an indistinct, coarse median carina, which does not extend to the posterior margin; hinder edge concavely incised.

Scutellum anteriorly black, or with one or two black spots on each side; disc scarlet, orange or black, sides margined with yellow; wider than long, one-half to three-fourths the length of the pronotum. Metanotum and upper surface of abdomen (visible through wings) ranging from yellowish, varyingly marked with black, to black. Underside mostly black, with ventral carina and edges of segments pale testaceous. Legs ochraceous or testaceous; swimming hairs golden brown to black; anterior femora broad, on inner surface concave, the greatest width equal to half the length; anterior tibiae about one-third longer than tarsi, which are four times as long as the longer claw; intermediate femora one-fourth longer than the tibiae, which are more than one-third longer than tarsi; first segment of tarsus three-fourths longer than the other. Length, 7 mm. to 8 mm.; width, 2 mm. or a little more.

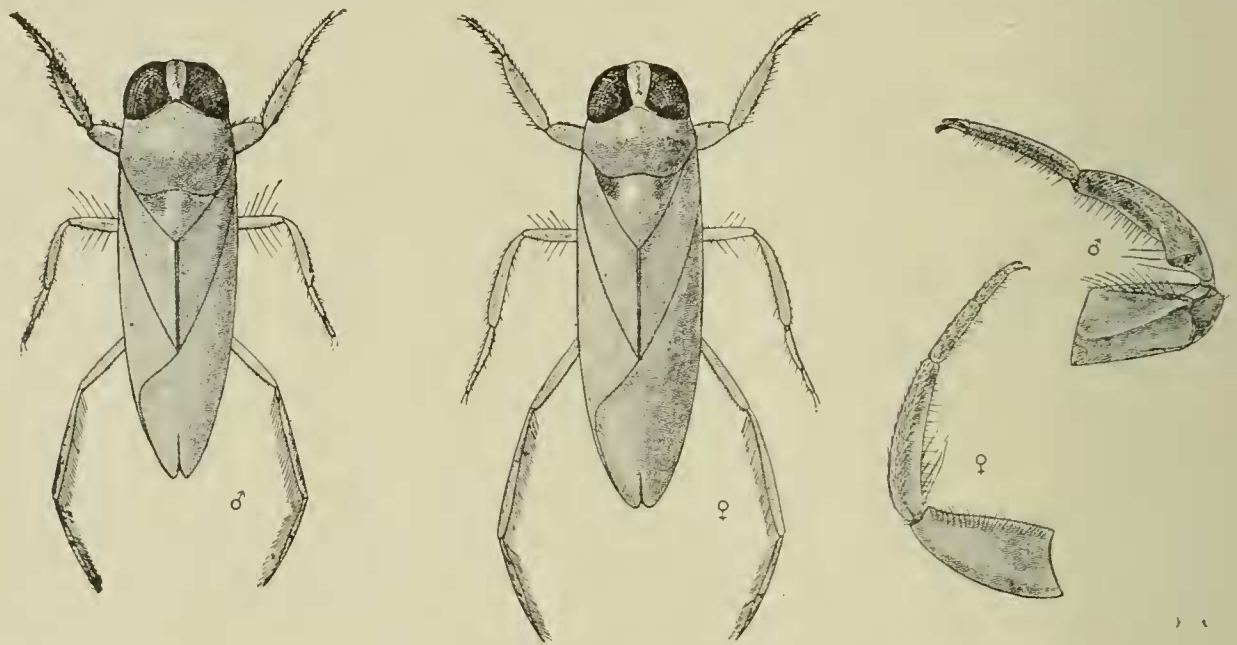


Fig. 365. *Anisops hyperion*.

♀ Pronotum a little wider than in male; vertex 1.5 to twice wider than synthlipsis, which is about three times in the width of an eye (less than four times in the type). Pronotum much shorter than in male, the length barely two-thirds the humeral width. Scutellum three-fourths of length, to about as long as the pronotum. Anterior femora not expanded, the greatest width (at base) being less than half the length; anterior tibiae about two-fifths longer than tarsi, the first segment of which is almost twice as long as the second. Intermediate tibiae less than one-fourth longer than tarsi. Length, 7 mm. to 8.6 mm.; width, 2 mm. to 2.5 mm.

Hab. South Australia: Adelaide, Mount Lofty Ranges, Port Willunga, Murray River and Northern Flinders Ranges, 2,000 ft. (H. M. Hale), Myponga

Swamps (A. H. Elston and H. M. Hale), Lucindale (B. A. Feuerherdt), Beachport, South-Eastern districts (S. S. Stokes), Bordertown (J. G. O. Tepper), Baldina Creek (A. Zietz), Mount Parry (Tate); Queensland: Longreach (A. M. Lea), Rockhampton (type locality); New South Wales: Broken Hill (F. W. Shepherd); Victoria: (*vide* Kirkaldy); Western Australia: Mullewa (Miss J. F. May).

The specimens from Broken Hill are largely jet black, with the scarlet of the scutellum prominent.

This species superficially resembles *A. stali*, but may be easily recognized by the smaller size, larger head, and by the very different anterior legs. *A. hyperion* was originally described from female examples taken in Queensland; the proportions of the intermediate legs of the above specimens differ a little from those of the type, the tibiae being more than one-sixth longer than the tarsi. In the female the uncovered portion of the scutellum is rarely more than the length of the pronotum.

In his "Über Notonectiden" (1904), Kirkaldy gives a short description of both sexes, and adds the following localities: Victoria (Kirk.'s collection); New Caledonia and Marianne Islds. (Paris Mus.); Viti Islds.: Ovalau.

He then expresses doubt as to whether he has not confused two species; the males described by him are 6 mm. to 7 mm. in length, with the anterior claws longer than in the males of the Australian species herein determined as *A. hyperion*; the examples recorded under this name from New Caledonia, etc., by Kirkaldy, and later by Distant⁽³⁾ may prove to represent another species.

BIOLOGY AND LIFE HISTORY OF *ANISOPS HYPERION*.

A. hyperion is the commonest representative of the genus in South Australia, occurring in both running and stagnant water. As with other species of the genus, its poise in the water is almost perfect; after ascending to the surface, where the tip of the venter is exposed for a second or so, the bug darts down a few inches; slowly, however, it commences to rise, but a stroke of the swimming legs counteracts this buoyancy; gradually the tendency to automatically ascend becomes less marked, and finally the insect commences to slowly sink, so that a reverse movement is necessary to regain equilibrium until the surface is again visited. The bug, therefore, is never actually motionless in the water, but is continually jerking up and down, or down and up.

Food. The food consists of aquatic animals small enough to be mastered; for more than eight months examples confined in battery jars were maintained

(3) Dist., Nova Caledonia, Zool., i, 1914, p. 386.

upon mosquito larvae and pupae, both of which are captured with ease: indeed, the adults and, to a lesser degree, the fifth instar nymphs, appear to favour the pupae, for if such are present they are taken before the larvae. The victims are securely held beneath the comb-like bristles arming the margins of the anterior and intermediate legs, and are dexterously turned about as the beak is applied to fresh portions. The rapacity of the bugs is remarkable; unless unduly disturbed, examples which have captured a "wiggler" do not relinquish their prey when lifted out of the water during transit to another vessel.

Throughout the life cycle the nymphs also fed upon this diet; egg rafts of *Culex* were placed in the jars containing the hatching bugs, and the tiny emerging larvae were easily captured by the precocious nymphs. Between the second and final moults (a period of less than four weeks) isolated examples on an average each accounted for about 200 medium sized larvae, while during the first two stages many hundreds of newly-hatched larvae were eaten. A laying female during one month caught 33 large larvae and 37 pupae of *Scutomyia notoscripta*.

Breeding Habits. There are at least two generations every year, eggs being deposited as late in the season as April, the progeny wintering as adults and breeding the following summer. Copulation has been noted at the beginning of August.

With the object of recording the breeding and other habits of the species, examples hatched during the summer were installed in balanced aquaria towards the end of the season (April). Throughout the winter these bugs remained active and feeding. In early spring mating took place, and the first batch of larvae hatched on October 27th.

The courtship is most fascinating: the male, stridulating rapidly the while, poises below and a little behind the female, and in this position accompanies her every movement; finally, with the extended posterior legs quivering with excitement, he attempts to clasp her from below. He is not, however, in any way faithful to one consort, for if another female passes near, and the first has not responded, position is taken below the new-comer; if she proves more amenable a union is effected and the couple remain *in copula* for an hour or more; the male occupies a position below and slightly to the right side of the female (that is to the left, as the bugs are viewed upside down), the curious, finger-like anterior tarsal claws enabling him to maintain his embrace.

A description of the stridulatory apparatus of the male of *Anisops* is given in the introduction to this paper. When *A. hyperion* is stridulating the anterior legs are flexed still more than usual, the tarsi almost touching the body; the base of the tibia moves up and down over the rostral prong with extraordinary rapidity, and sometimes a tiny, silvery bubble may be seen at the point of

friktion; the sound is often maintained for long periods; in mid-winter one example continued its song intermittently during the whole of one day, as is the case during breeding. Stridulation commences with a rapid series of squeaky notes, not loud, but continued for a minute or more; the notes then become slightly louder and more metallic, and finally merge into a shrill and loud chirrup, which is not sustained, the song soon sinking to *pianissimo* or ceasing altogether. When sitting near an aquarium containing stridulating *Anisops*, the effect is as of a distant grindstone at work, with the sound borne very faintly to the ear. Sometimes the characteristic chirrup is produced without the preliminary fainter notes, and *vice versa*, but in any case the stridulation is quite easily distinguished from the fewer and less quickly repeated notes of Corixids.

Oviposition. It has been mentioned that an examination of the female genitalia of the Australian species shows that all insert their eggs in plants. Some thick stems of *Potamogeton tricarinatus*, an indigenous water-plant, were anchored close to the glass of an aquarium containing some of the bugs under observation, and it was thus possible to watch the whole process of oviposition. The female grasps a stem with the anterior and middle legs and curves the abdomen so that its tip is almost touching the surface of the plant; the orifice opens and the point of the ventral carina explores the stem, the insect meanwhile walking down the support until a suitable site is selected. The genitalia are then extruded, the point of the abdominal keel is firmly applied and kept rigid, and quite close to it the drilling gonapophyses work at the stem with a circular, scraping motion; the epidermis is soon penetrated and an oval cavity is gouged out of the plant tissue. As the hole increases in size the tip of the carina slips into it at the lower edge (the insect being head-downwards), while all the time the drilling organs can be seen inside the semi-transparent stem, operating with a characteristic gouging movement.

When the hole is completed there is a short pause; then an egg is inserted, leaving a small portion of the anterior surface exposed at the mouth of the cavity. Finally the sensitive lip of the pygidium moves over and about the exposed portion of the egg, as if to make sure that all is well; the silky hairs of the posterior abdominal segments and ovipositor are doubtless to some extent tactile. The actual drilling of the *Potamogeton* tissue occupied from 35 to 50 seconds, the insertion of the ovum about 15 seconds. After an egg is laid the female swims away, vigorously cleaning the tip of the abdomen with the posterior legs and constantly exposing the genitalia while doing so. Oftentimes the female settles on a stem, explores the surface with the closed tip of the abdomen, and floats off again, as if dissatisfied with the location; if the ovipositor is extruded, however, one can be sure that, if not disturbed, the female will insert an egg

before leaving the stem. The bugs are shy during copulation and oviposition, and are rather easily disturbed in either act.

Period of Oviposition. In a jar containing one male and three females, the latter were simultaneously depositing eggs on November 1st; each laid only a few eggs a day, oviposition being most active after mid-day, when the sun was shining into the laboratory; at this time of day the male seemed greatly excited, frequently stridulating, poising beneath the females, and attempting to clasp them from below. On November 20th one of them, which had completed oviposition, was floating venter uppermost at the surface, apparently unable to maintain its poise, and shortly died; on this date the male was again *in copula* with one of the remaining females, both of which continued laying until about November 22nd, on which date the first of these nymphs hatched. The second female died on the 24th, and all weed was now removed from the vessel, so that the surviving female, which had not completed egg-laying, had perforce to cease ovipositing. The male perished on the 29th, but the female remained quite healthy for the following three weeks; at the expiration of this time a fragment of *Potamogeton* was dropped into the jar, and the interrupted oviposition was immediately continued, two eggs being laid in rapid succession. The survivor lived until the middle of January, 1923.

The Nidus. A plant stem or leaf of sufficient thickness to accommodate the eggs, and which the ovipositor is capable of drilling, is utilized if such be present; when indigenous *Potamogeton* and *Myriophyllum* are growing in localities favoured by *Anisops* the stems of these plants are usually found to contain eggs.

As an experiment a gravid female was isolated in a jar containing only small plants of *Vallisneria spiralis*, the thin leaves of which are ill suited for the reception of the ova. A great number of slits in the leaves indicated abortive attempts to prepare suitable receptacles, and the eggs deposited in this nidus were but partially concealed, so that it was possible to photograph them *in situ* (pl. x, fig. 3-4).

Period of Development. About a fortnight after deposition the eggs exhibited the first traces of the red eye pigment of the enclosed embryo, and in another week the nymphs emerged. This period for incubation obtained with the water at a mean temperature of 67° F., but the time varies according to the temperature of the water and the season of the year; eggs deposited in December developed more rapidly, the eye-pigment appearing in a few days. The skin is moulted five times during the metamorphosis, the first four instars each occupying about a week, the fifth a little longer. In aquaria the individual variation in the periods between moults was as follows:—First, 7 days; second, 7-8 days;

third, 6-8 days; fourth, 7-10 days, and the fifth about 10 days. Thus the nymph attains maturity about two months after the egg is laid.

Habits of the Nymphs. The newly-hatched nymphs, as in the case of larvae of other Notonectid genera observed by Hungerford, are singularly helpless until the guard hairs have become charged with air; after tumbling about in awkward efforts to attain the surface film, they sink to the bottom exhausted. Several examples in this condition were placed in a small dish containing water to the depth of half an inch, and after three days none had filled its guard hairs; possibly during this period respiration was effected through the skin by osmotic action. They were then placed in a "balanced" aquarium containing ample weed, and next morning, with guard hairs filled, all were poised in the water, active and feeding. These first instar nymphs remain quite near the surface and behave much as do the imagos. In situations where *Anisops* is breeding, they do not mingle with the more developed examples, but congregate in the shallowest water at the margins of the pools, the shoals often comprising many thousands of individuals; adults do not appear to prey upon these swarming nymphs.

The moulting is not the least interesting phase of the metamorphosis: the skin splits along the dorsal median line of the thorax (where it is weakest), but the integument of the abdomen is unruptured; the skin of the head splits at the junctures of the eyes and notocephalon. The legs are drawn out of the previous sheaths, leaving the last-named, complete with swimming hairs, spines, etc., intact; the abandoned skin floats at the surface, a hollow replica of the nymph from which it is practical to compute leg and other measurements. Occasionally a nymph fails to rupture the skin and so dies; in an example which has perished thus the dorsum is characteristically humped owing to the abortive effort to burst the skin. After each moult the bug immediately expands to the proportions of the next instar.

Developmental Changes. The first instar nymph has no ventral carina on the abdomen and, even towards the end of the instar, very little pigment on the venter. The claws, as in the adult, are unequal, but are relatively much larger, decreasing regularly in proportion to the size as the bug grows; the posterior claws, for instance, are conspicuous in the first instar nymph, and measure one-fifth of the length of the tarsus, while in the adult they are small, hidden by the swimming hairs, and but one-tenth of the length of the tarsus. The anterior and intermediate tibiae and tarsi are concave on their inner surfaces as in the imago, but all the tarsi are single-jointed until after the final moult. The width of the synthlipsis in relation to that of the vertex does not differ greatly throughout the life history, but the eyes are at first small and the notocephalon is proportionally

much wider than in the imago. As successive instars are attained, the eyes become larger and more rounded.

Below is a description of each stage of the life history, following which is a table giving the average measurements of several specimens of each. The life history is illustrated on pl. xi, fig. 1 to 9.

The egg. Surface with small hexagonal reticulations. Colour pearly white when first laid, ochraceous, with red eye spots as development proceeds. Length, 1.32 mm.; widest diameter, .52 mm., rather more as the enclosed bug attains larger proportions.

First instar nymph. Head somewhat conically produced in front of the small, widely separated eyes; vertex nearly twice as wide as the synthlipsis, which is one-third of the width of the head. Anterior and intermediate tarsi less than twice as long as the claws. (The longer claw of the pair terminating each tarsus is measured.) Lower edge of the posterior fulehra with a row of fine striae as in the adult. Swimming hairs rather sparse on posterior tarsus, almost absent on the tibiae. The colour is transparent whitish, with the eyes red, the guard hairs black, and the swimming hairs and a streak on the inner margin of the posterior tarsus dark brown. After the bug commences to feed the abdomen is dark owing to contained food, but as the instar draws to a close true pigmentation is slightly developed on the underside of the abdomen. Length, 1.8 to 1.9 mm.

Second instar nymph. Head less conically produced in front of the eyes than in previous instar; vertex slightly more than one and a half times the synthlipsis, which is three and a half times in the width of the head. A somewhat poorly developed ventral keel is now present, but the abdominal gutters are hardly apparent; the guard hairs are arranged as in the adult. A space on the venter between these is brown, and a faint dark streak appears on the underside of the posterior femora. Posterior femora, tibiae, and tarsi subequal in length. Anterior tarsi more than three times as long as claws, intermediate tarsi three times as long as claws. The swimming hairs on the posterior tarsi are denser, and a sparse fringe appears on the posterior tibiae. Length, 2.3 to 2.5 mm.

Third instar nymph. Head evenly rounded in front of eyes. Vertex about one and a half times the synthlipsis, which is one-fourth of the width of the head. The wing pads have appeared and extend past the first third of the thorax. Anterior and intermediate tarsi about three and a half times as long as their claws. Swimming fringes are developed on both margins of the posterior tibiae and tarsi. Limbs and under-surface in parts sooty; head ochraceous. Length, 3.2 and 3.56 mm.

Fourth instar nymph. Vertex about one and a half times the synthlipsis, which is 4.4 to 5.27 times in the width of the head. The wing pads extend to

beyond the middle of the length of the thorax. Anterior tarsi nearly four times longer than claws; intermediate tarsi more than four times longer than claws. Abdominal gutters now prominent. Pigment on venter of abdomen dark brown. Length, 4.12 to 4.5 mm.

Fifth instar nymph. Head much as in the adult, but notocephalon proportionally a little wider. The wing pads reach slightly beyond the posterior margin of the thorax. Anterior tarsi rather more than four times longer than the claws, intermediate tarsi more than four and a half times longer than claws. The pigment on the abdomen is almost black and the streak on the underside of the posterior femora is prominent; head and prothorax dark ochraceous.

In this instar the sex of each nymph can be determined, the immature males having the eyes more prominent, the notocephalon narrower, and the inner margins of the eyes rather less divergent, than in the other sex. Furthermore, by means of transmitted light, the two-jointed tarsi of developing females can be discerned through the integument of the single-jointed tarsi of nymphs nearing the final moult (pl. xi, fig. 9); similarly, the monomerous anterior tarsi and characteristic anterior tibiae of the male can be seen.

♂ Vertex, 1.34 to 1.8 times as wide as the synthlipsis, which is 4.5 to 6.8 times in the width of the head.

♀ Vertex, 1.35 to 1.5 times as wide as the synthlipsis, which is 3.4 to 4.6 times in the width of the head.

Length, 5.1 to 6.12 mm.

The imago. Newly moulted adults have a clear whitish appearance, with the underside of the abdomen brown; the scarlet of the scutellum and the dark colour on pronotum and dorsum of abdomen, etc., are developed later; the integument is at first soft, and the bugs shrivel if dried too soon after the metamorphosis is completed.

♂ Synthlipsis, 6.97 to 9.8 times in width of head.

♀ Synthlipsis, 6.1 to 8.0 times in width of head.

Other proportions are given in the general description of the species.

DIMENSIONS OF NYMPHS AND ADULTS.

Instar.	1	2	3	4	5	6 ♂	6 ♀
Total length	1.85	2.4	3.38	4.31	5.61	7.5	7.8
Greatest width . . . .	.6	.77	1.15	1.38	1.6	2.0	2.25
Width of head . . . .	.55	.7	1.0	1.14	1.48	1.7	1.78
Vertex . . . . .	.33	.32	.37	.4	♂ .417 ♀ .53	.36	.425

Synthlipsis . . . . .	.18	.2	.25	.26	♂ .29	.22	.256
					♀ .37		
Anterior femur . . . . .	.3	.35	.49	.65	.875	1.1	1.0
„ tibia . . . . .	.4	.48	.63	.837	1.135	1.37	1.29
„ tarsus . . . . .	.275	.33	.47	.6	.77	1.01	.93
Intermediate femur . . . . .	.425	.52	.79	1.1	1.365	1.7	1.72
„ tibia . . . . .	.36	.45	.675	.875	1.13	1.33	1.39
„ tarsus . . . . .	.275	.34	.50	.625	.8	.97	1.02
Posterior femur . . . . .	.65	.82	1.1	1.385	1.94	2.32	2.35
„ tibia . . . . .	.68	.81	1.0	1.31	1.57	1.85	1.93
„ tarsus . . . . .	.8	.83	.95	1.165	1.307	1.34	1.46

ANISOPS OCULARIS sp. nov.

♂ Head, including the large and prominent eyes, very slightly narrower than the pronotum; notocephalon with a swelling on each side, not reaching to base of head, converging at vertex and continued as a median carina on to the very narrow face; synthlipsis about 1.5 in vertex, 5 times in the width of an eye. Pronotum pale testaceous; as long as the head, twice as wide as long, with a

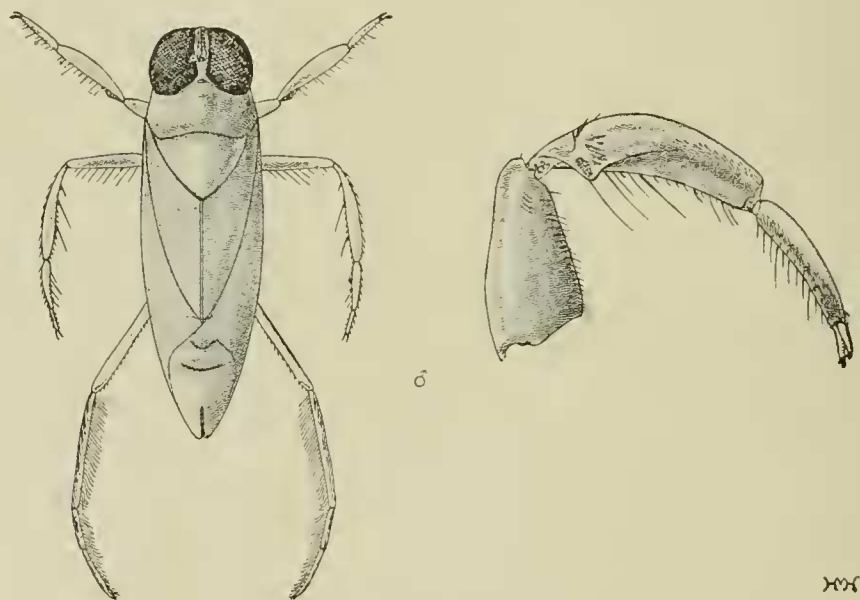


Fig. 366. *Anisops ocularis*.

feeble median carina, which disappears posteriorly; hinder edge slightly concavely incised. Scutellum testaceous, with a large, pale triangular patch near each anterior angle; wider than long, and about 1.25 times as long as the pronotum. Metanotum testaceous; upper side of abdomen pale, with the posterior segments in parts black. Underside of abdomen black, ventral carina and lateral edges ochraceous. Anterior tibiae much expanded, the greatest width (near the

base) being $\cdot 3$ of the length; anterior tarsi 1.6 times in tibiae, 3 times longer than the longer claw. Length, 8 mm.; width, 2.5 mm.

Hab. Northern Territory: Darwin (W. K. Hunt).

The type is the only representative of this species before me. As in *A. doris*, the eyes are large, the notocephalon is narrow, and the pronotum is short; it differs, however, in the wider synthlipsis, the markedly more robust form, the much more expanded anterior tibiae of the male, etc. It resembles Distant's description and figure of *A. cleopatra* from New Caledonia, but in that species the synthlipsis is "not more than half" as wide as the vertex and the size is smaller.

ANISOPS GRATUS sp. nov.

♂ Head, including eyes, narrower than the pronotum; notocephalon with a median groove, on each side of which is a slight swelling; synthlipsis little more than 2 times in vertex, 5 times in the width of an eye. Pronotum almost one and a half times wider than long, with scattered punctures and a median fovea; posterior margin concavely incised, lateral margins divergent. Scutellum yellow, shorter than the pronotum; wider than long. Legs slender; anterior thigh 1.3 times tarsus; longer claw 2.5 in tarsus. Length, 7 mm. to 8.5 mm.; width, 2 mm. or slightly more.

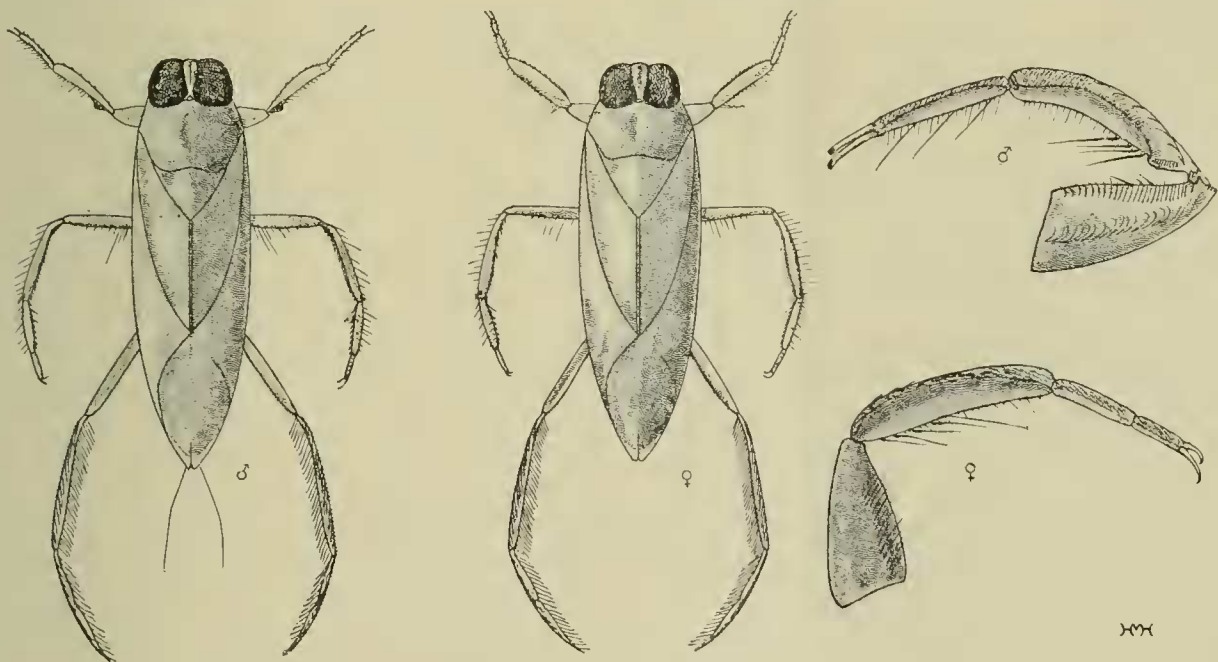


Fig. 367. *Anisops gratus*.

♀ Synthlipsis 2.5 to 3 in vertex, 4 to 5 times in the width of an eye. Pronotum a little shorter than in male. Scutellum about same length as pronotum, as wide as long. First joint of anterior tarsus almost twice as long as second; claws shorter than in male. Length, 7 mm. to 9 mm.; width, 2 mm. to 2.5 mm.

Hab. South Australia: Murray River (H. S. Copè), Adelaide and Port Willunga (H. M. Hale), Lueindale (B. A. Feuerheerdt), Bordertown (J. G. O. Tepper), Summertown (Pullman); Central Australia: Lake Callabonna (A. Zietz); Queensland: Karoongooloo Station (H. S. Allnutt); New South Wales: Broken Hill (F. W. Shepherd, type locality); Western Australia: Mullewa (Miss J. F. May).

In this species the synthlipsis is narrower than in *A. hyperion*, *stali*, or *endymion*; a more robust form and smaller head at once separate it from *A. doris* and *fieberi*. The eyes of the male are occasionally much closer at the base of the head than in the type; in one example the synthlipsis is 4 times in the vertex and 10 times in the width of an eye. Although the synthlipsis varies thus, the vertex remains approximately the same, about 2.5 times in the width of an eye.

The delicate colours of *A. gratus* soon fade after death; the colouration of fresh samples collected by Mr. F. W. Shepherd in New South Wales, and by myself in South Australia, is as follows: Notocephalon very pale yellow, almost white. Pronotum orange, paler anteriorly. Scutellum clear lemon yellow, posteriorly suffused with orange. Metanotum and anterior part of upper side of abdomen (as seen through wings) clear lemon yellow, posteriorly delicately shaded with orange; sides of abdomen pale pink, the edges of segments shaded with brown; sternum yellow, underside of abdomen black, in parts yellow. Legs pale, coxae, femora, and tibiae marked with brownish-black on inner surfaces.

ANISOPS STALI Kirkaldy.

Notonecta australis Stal, Ofr. K.V.Ak. Forh., xii, 1855, p. 190 (nec. Oliv.).

Anisops australis Stal, Eugenie Resa, 1859, p. 267.

Anisops stali Kirk., Wien. ent. Zeit., xxiii, 1904, p. 113.

♂ Head, including eyes, much narrower than the pronotum; notocephalon ochraceous, produced downwards and slightly outwards in front of eyes, the anterior margin being truncate and a little concave, with a small projection at each angle; anterior three-fourths with a median, punctured groove, on each side of which is a swelling with an impressed line of punctures defining its outer margin; these tumidities converge anteriorly and meet in the middle of the front edge of the notocephalic projection; synthlipsis 1.3 to 1.5 times in the distance between the anterior angles of the eyes, and 2.3 to 2.5 in the width of an eye; face seen in profile, concave, so that the lower part of the eye projects in front of it on each side. Pronotum white, posteriorly black or reddish, about 1.5 times wider than long, with some indefinite punctures and an indistinct, coarse, median carina, which vanishes posteriorly; hinder margin concavely incised; lateral margins moderately oblique. Scutellum yellow or orange, anteriorly more

or less infuscated with red and sometimes with a small triangular black spot near each anterior angle; about as long as the pronotum. Metanotum and upper side of abdomen testaceous marked with black, or black. Underside of abdomen black, with ventral carina and edges of segments testaceous. Anterior tibiae 1.6 times longer than tarsi, which are more than twice as long as the claws. Length, 11 mm. to 12 mm.; width, 3.2 mm. to 3.5 mm.

♀ Vertex not produced as in male, projecting only very slightly in front of the eyes; swellings on notocephalon a little larger and converging on face, which, seen in profile, is almost straight; synthlipsis 1.3 to 1.5 in vertex, 2.1 to 2.5 in the width of an eye. Pronotum about 1.75 times wider than long. Scutellum longer than pronotum. Anterior tibiae 1.6 times longer than tarsi; first tarsal segment 1.5 times longer than second, which is little longer than a claw. Length, 10.5 mm. to 13 mm.; width, 3 mm. to 3.5 mm.

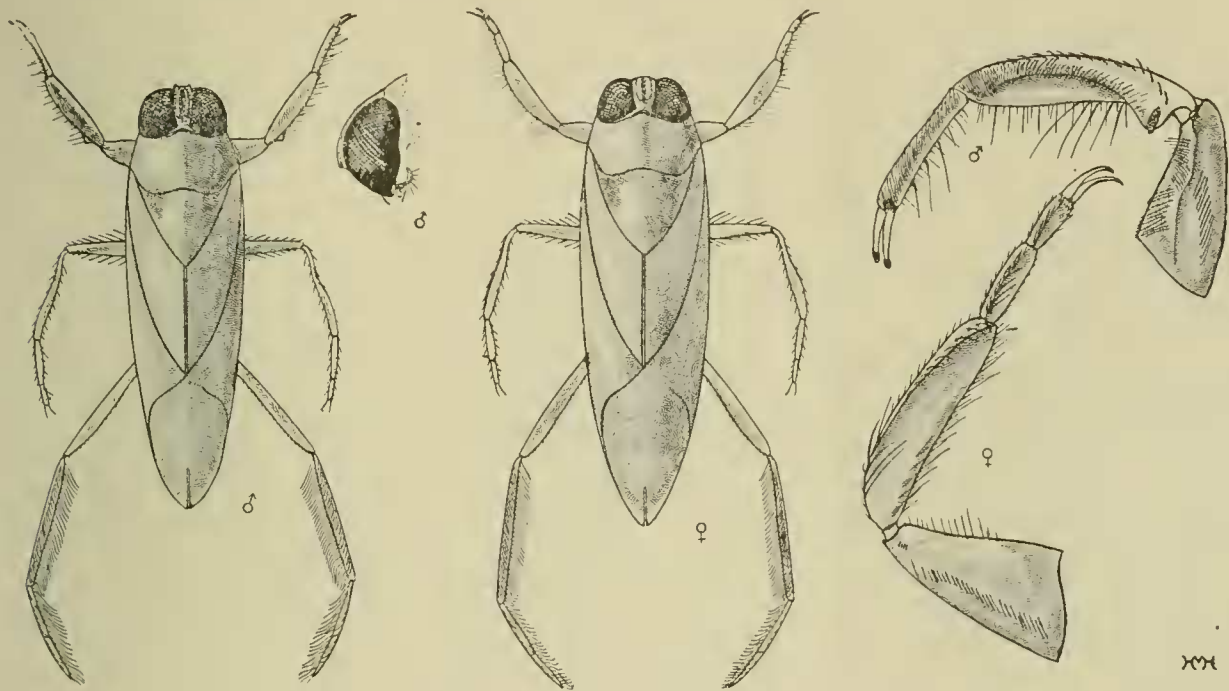


Fig. 368. *Anisops stali*.

Hab. South Australia: Murray River (H. M. Hale), "N.W. of South Aust." (Dr. H. Basedow), Bordertown (J. G. O. Tepper), Cordillo Downs (F. Archer; Central Australia: Cooper's Creek (J. G. Renter), Boorgline Waterhole (Elder Expedition), Andamed Station (A. F. Roberts); Northern Territory: (Capt. S. A. White), Port Darwin; Queensland: Cunnamulla (H. Hardeastle), Karoongooloo Station (H. S. Allnutt); New South Wales: (type locality), Hay (A. M. Lea); Western Australia: Wyndham (S. Stephens).

This is the largest species recorded from Australia. Its form is robust, the body being deep and, seen sideways, considerably arched on the back, so that the

downward inclination of the head is rather more marked than in the other forms; the stout anterior legs are distinctive in their proportions. According to Kirkaldy's measurements, the intermediate tibia of the male is relatively shorter than in the female, but I can find little difference in the examples now examined.

ANISOPS CALCARATUS sp. nov.

♂ Head, including eyes, narrower than the pronotum; notocephalon with a median groove, which does not extend to hinder margin of the head and with a swelling on each side; synthipsis less than 1.5 in vertex, 3.5 times in the width of an eye; notocephalic swellings uniting at the front of the head and continued on to face as a strong, median carina; eyes large, prominent, projecting slightly in front of vertex. Pronotum sordid testaceous, about 1.5 times wider than long, with a coarse, median carina reaching to posterior margin; lateral margins divergent; hinder edge evenly convex. Scutellum testaceous, wider than long, a little longer than the pronotum. Metanotum testaceous, with a black spot on each side; upper side of abdomen testaceous, posterior segments black. Anterior

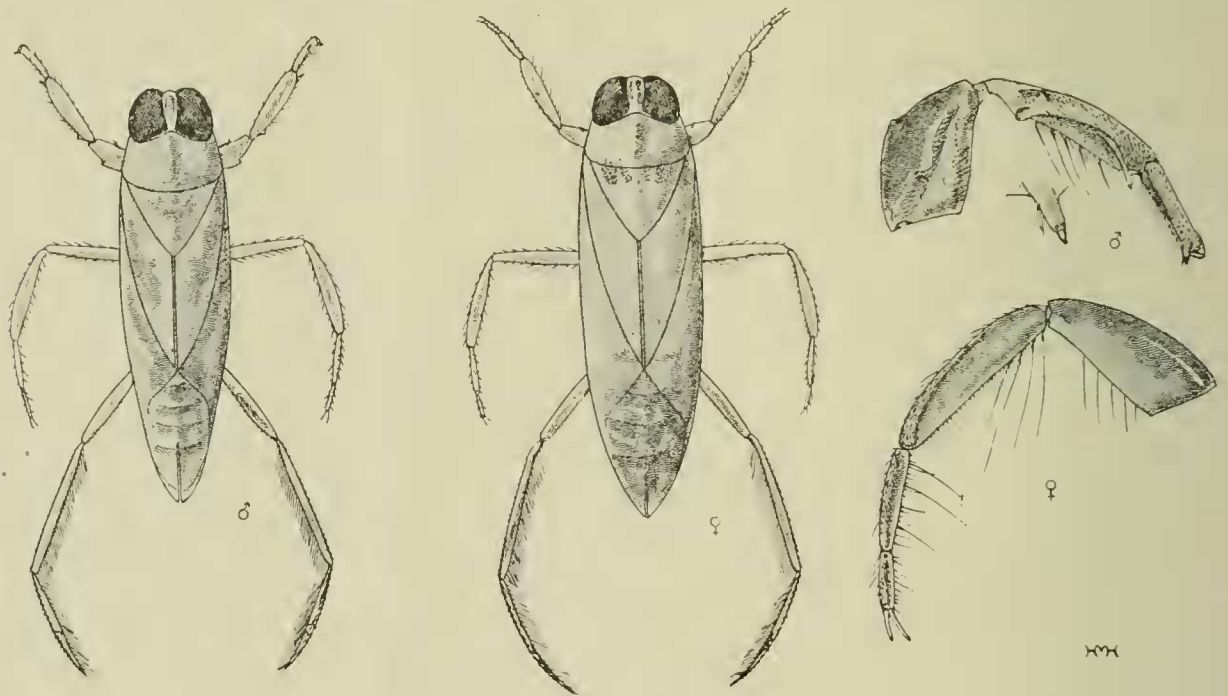


Fig. 369. *Anisops calcaratus*.

femora stout, the superior edge with a knife-like ridge, which gradually rises until it attains a point beyond the middle of the length of the thigh, where it abruptly terminates; summit of this ridge set with very small prostrate spines; tibiae strong, the anterior end of the inner face with a distinct spur, in the apex of which is set a short, stout spine; tarsi damaged. Length, nearly 9 mm.; width, 2.4 mm.

♀ Eyes not so prominent, and notocephalon wider than in male. Synthlipsis 1.5 in vertex, 3 times in the width of an eye. Pronotum about twice as wide as long, with a coarse, median carina; hinder margin convex. Scutellum pale yellow to orange; sometimes with a black spot on each side anteriorly; 1.5 times as long as the pronotum. Anterior femora not ridged on superior edge; anterior tibia one-fourth longer than the tarsi, the first tarsal segment nearly twice as long as the second, which is less than twice the length of the longest claw. Length, 8 mm. to 9.5 mm.; width, 2.5 mm. to 3 mm.

Hab. South Australia: Bordertown (J. G. O. Tepper, type locality); Queensland: Cunnamulla (H. Hardeastle).

The type, which is somewhat damaged, is the only male of this distinct species as yet received. The convex posterior margin of the pronotum distinguishes it from all other Australian forms, excepting possibly *A. endymion* Kirk.; in the description of the last-named species the character of the hinder edge of the pronotum is not stated, but the synthlipsis is described as about half the width of an eye and but slightly narrower than the vertex, while the pronotum is relatively longer and the scutellum shorter than in the female of *A. calcaratus*.

ANISOPS ENDYMION Kirkaldy.

Anisops endymion Kirk., Wien. ent. Zeit., xxiii, 1904, p. 114.

“Elytra ash-coloured, transparent. Posterior half of exocorium and the clavus smoke-coloured, anterior half of clavus, basal margin of corium and the basal half of exocorium, black. Veins of wings pale. Metanotum brownish-black, lateral margins pale. Legs pale. Abdomen above dull, pale, in the centre black. Below black. Crown longitudinally grooved, hardly broader on the anterior margin than on the synthlipsis, the breadth of the latter barely half the width of an eye.

Anterior margin of the pronotum between the eyes much more distorted than in other species (the distorted portion rounded anteriorly); pronotum three-fourths broader than its length, longer than the scutellum. Anterior and middle tibiae flat and laterally expanded, broader at end than at base; one-fifth times longer than tarsi, first tarsal segment two-fifths longer than the other, which is two and a half times as long as the claw. Length, 9 mm.; breadth, 3 mm.

Hab. Australia: Swan River (Perth Museum, Scotland).

Only a single female of this distinct species is before me.”

I have not seen this species, and as the publication in which it is described is not included in our libraries a translation from the German of the original description is given above. *A. endymion* differs from the other species herein described in the wider notocephalon.

NOTONECTA Linnaeus.

Notonecta Linn., Syst. Nat., ed. x, 1758, p. 439; Fieb. Rhynchotogr., 1851, p. 48; Flor., Rhynch. Livl., i, 1860, p. 766; Saund., Hem. Heteropt. Brit. Is., 1892, p. 329; Kirk., Trans. Ent. Soc., 1897, p. 397.

Type, *N. glauca* Linnaeus.

Only one Australian species may be definitely assigned to this almost universally distributed genus; no *Notonectae* occurred amongst the considerable amount of material examined for the preparation of this paper.

NOTONECTA HANDLIRSCHI Kirkaldy.

Notonecta handlirschi Kirk., loc. cit., p. 408.

Kirkaldy remarks: "Something like *N. americana* Fabr., but with the pattern and colour very obscure. I have very great pleasure in dedicating this species, the first true *Notonecta* from Australia, to Dr. Handlirsch, of the Vienna Museum."

Loc. "Australia." Type in Vienna Museum.

? NOTONECTA AUSTRALIS Olivier.

Notonecta australis Oliv., Encycl. Method., viii, 1811, p. 389.

Notonecta (? *Anisops*) *australis* Kirk., Trans. Ent. Soc., 1897, p. 426.

Kirkaldy, in his "Revision of the Notonectidae. Part I," was unable to trace this species, which he suggests may be an *Anisops*. Olivier's short description is practically confined to colour; in *Enithares bergrothi* the colouring is quite similar.

"Elle se trouve à la Nouvelle Hollande. Du cabinet de M. Bosc."

ENITHARES Spinola.

Enithares Spin., Ess. Hem., 1837, p. 60; Stal., Hem. Afr., iii, 1865, p. 190; Kirk., Wien. ent. Zeit., xxiii, 1904, p. 95.

Bothronotus Fieb., Rhynchotogr., 1851, p. 46.

Enithara Sign., Ann. Soc. Ent. Fr., (3), viii, 1860, p. 971.

Type, *E. indica*, Fabr.

Form robust; pronotum wide and short, with a foveate excavation at each anterior angle.

ENITHARES BERGROTHI Montandon.

Enithares bergrothi Montand., Rev. ent. franc., xi, 1892, p. 75; Kirk., Wien. ent. Zeit., xxiii, 1904, p. 105.

Enithara australica Signoret, Samml. (MS.).

?*Bothronotus luniger* Fieber, Abhand. der königl. böhm. Ges. der Wiss. (5), vii, 1852, p. 741. (White form.)

Plate x, fig. 1.

Notocephalon pale, basally wrinkled or punctate and with a low triangular tubercle at hinder margin; punctate on each side towards vertex, and with a line of punctures bordering each eye; vertex twice or a little more than twice as wide as synthlipsis, which is rather less than half the width of an eye. Pronotum black on posterior half, sometimes with the front edge broadly margined with black; foveate excavations ochraceous or black; about 2.5 times wider than long; anterior half densely punctured and finely wrinkled; posterior half smooth and

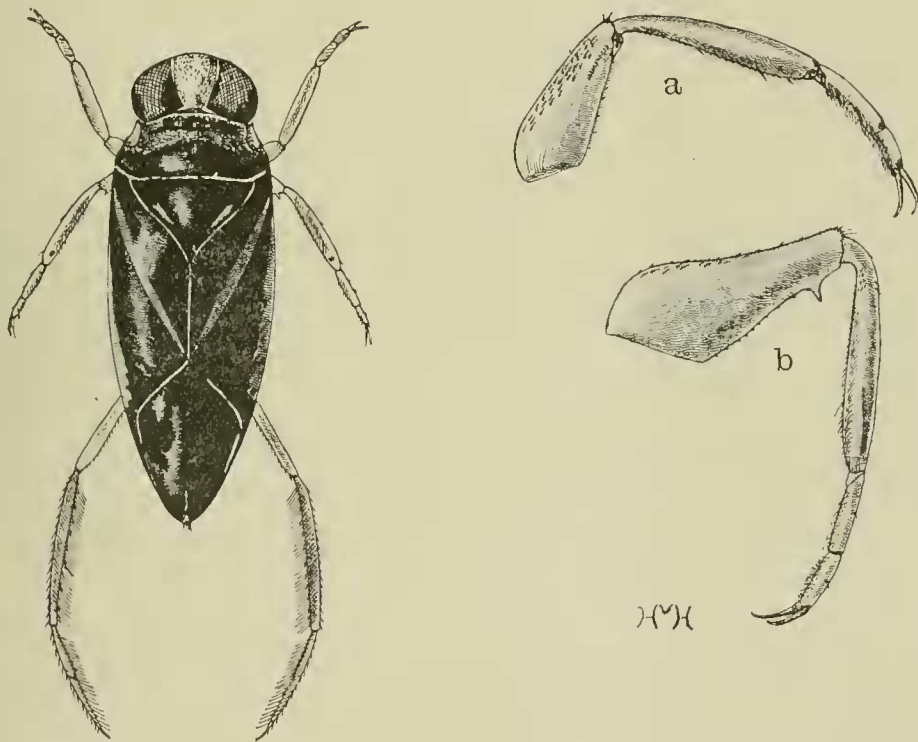


Fig. 370. *Enithares bergrothi*; a and b, anterior and intermediate legs.

polished, with a few small, scattered punctures. Scutellum pale or black, often with an oblique, ochraceous dash of varying shape on each side; about 1.5 times longer than pronotum, densely covered with fine punctures. Hemelytra black, sometimes paler laterally and on claval suture; clothed with tiny hairs; shining and densely covered with minute punctures. First joint of anterior tarsus about twice as long as the second; claws equal, as long as the second tarsal segment;

intermediate femora with a spur or tooth near the apex; intermediate tibiae about 1.5 times longer than the tarsi, the first segment of which is 1.5 times longer than the second; claws unequal, the longer one almost as long as the second tarsal segment. Length, 10 mm. to 12 mm.; width, 3.5 mm. to 4.5 mm.

Hab. South Australia: Adelaide, Mount Lofty Ranges, South-Eastern districts, etc., etc. (H. M. Hale), Myponga (A. H. Elston, etc.), Beachport (S. S. Stokes); Northern Australia (Belgium Museum, etc., *vide* Kirk.); Queensland: Kuranda (R. W. Armitage), Cape York (Belgium Museum, etc., *vide* Kirk.); New South Wales: Mittagong (A. M. Lea), Como (W. W. Froggatt); Victoria: Macedon, Melbourne and Plenty River (Searle), Melbourne, etc. (Paris, Stockholm, and Belgium Mus., etc., *vide* Kirk.); Eastern Australia and Tasmania (Paris Mus., *vide* Kirk.); Tasmania (A. Simson); Western Australia (Kirk., "meine Samml."); New Caledonia (type locality); Balade Is. (Paris Mus., *vide* Kirk.).

The colour is variable; pale examples confined in aquaria eventually became black, excepting for the head, legs, and part of the pronotum. The life colouring of a typical adult specimen is as follows:

Notocephalon gray, laterally margined with translucent yellow, posteriorly with a bluish-black triangular marking, the basal angles of which touch the inner posterior angles of the eyes; vertex suffused with bright, dark green (graminaceous); eyes dark rose; beak and face graminaceous, the last-named laterally margined with dark yellow. Pronotum black on posterior half, gray marked with black anteriorly, laterally tinged with green. Scutellum black, with a pale yellow dash on each side. Remainder of upper side black. Underside of abdomen black, with ventral carina and lateral edges graminaceous, and edges of segments castaneous. Upper surfaces of legs green, in parts tinged with yellow; lower surfaces dark green, more or less marked with brown; anterior femora with two dark brown streaks below and posterior femora with a dark brown stripe beneath; hairs brown.

In the living bug the black first appears in patches, which spread until the fine, uniform atrous colour is attained. For instance, on the scutellum a black median streak, or a black triangular patch with its base on the anterior margin of the scutellum, is first apparent; this patch grows larger until only a small pale dash is left on each side (fig. 370), and finally even these pale portions disappear.

This species is taken farther from the banks than is *Anisops*, and rarely congregates in large numbers, as do the last-named backswimmers. It has a habit of clinging to submerged objects or floating at the surface in deep water. Its food consists of any aquatic animal small enough to be mastered, and it has been

observed to capture and feed upon fifth instar nymphs of *Anisops*. The first nymphs of the season appear in early spring.

A resident in the Mount Lofty Ranges, who was recently stung as a result of incautiously handling one of these bugs, remarked that the effect was somewhat similar to that of a bee sting. The poisonous nature of the tiny wound was testified by the swollen condition of the punctured hand.

SUB-FAMILY PLEINAE.

PLEA Leach.

Plea Leach, Trans. Linn. Soc., xii, 1817, p. 11; Saund., Hem. Het. Brit. Is., 1892, p. 329; Kirk., Wien. ent. Zeit., xxiii, 1904, p. 126.

Ploa Stephens, Cat. Brit. Ins., ii, 1829, p. 354.

Ploca Doug. and Scott, Cat. Brit. Hem., 1876, p. 61.

Type, *P. minutissima* Fabr. (= *P. leachi* M'Gregor and Kirkaldy).⁽⁴⁾

Form stout, size small. Eyes widely separated and rostrum three-jointed. Inner edges of elytra meeting at the median line of the body.

PLEA BRUNNI Kirkaldy.

Plea brunni Kirk., Wien. ent. Zeit., xvii, 1898, p. 141, and xxiii, 1904, p. 128.

Notocephalon ochraceous, about twice as wide as an eye, closely punctate; face usually with a dark castaneous, central, longitudinal line, which is sometimes widened and diffused, sometimes with a dot on each side near vertex, and occasionally forked near vertex, forming a Y-shaped figure; hinder margin of head dark castaneous. Pronotum testaceous or ochraceous, often darkened near humeral angles; 1.3 times wider than its length; coarsely, reticulately punctate, but with a median, longitudinal portion very slightly raised, shining and not punctate. Scutellum dark testaceous or ochraceous, distinctly punctured, hardly half as long as the pronotum. Elytra of like colour, with brown, coarse, reticulate punctures. Wings well developed. Underside black; legs ochraceous; anterior tarsi less than half as long as tibiae; intermediate tarsi about half as long as tibiae; posterior tibiae 1.3 times longer than tarsi, the first joint of which is longer than second; posterior legs distinctly more ciliated than the others, with the claws strong and almost three-fourths of the length of the second tarsal segment. Length, 2 mm. to 2.4 mm.; width, 1 mm. to 1.4 mm.

Hab. South Australia: Murray Bridge and Myponga Swamps (H. M. Hale); Northern Territory: Port Darwin; Queensland: Gladstone (A. M. Lea),

(4) Trans. Perthshire Soc., 1899, p. 5.

Cunnamulla (H. Hardeastle), Rockhampton (type locality); New South Wales: Clarence River (A. M. Lea); Tasmania: George Town; Western Australia: Albany (*vide* Kirk.); New Guinea (Mus. Genoa, *vide* Kirk.).

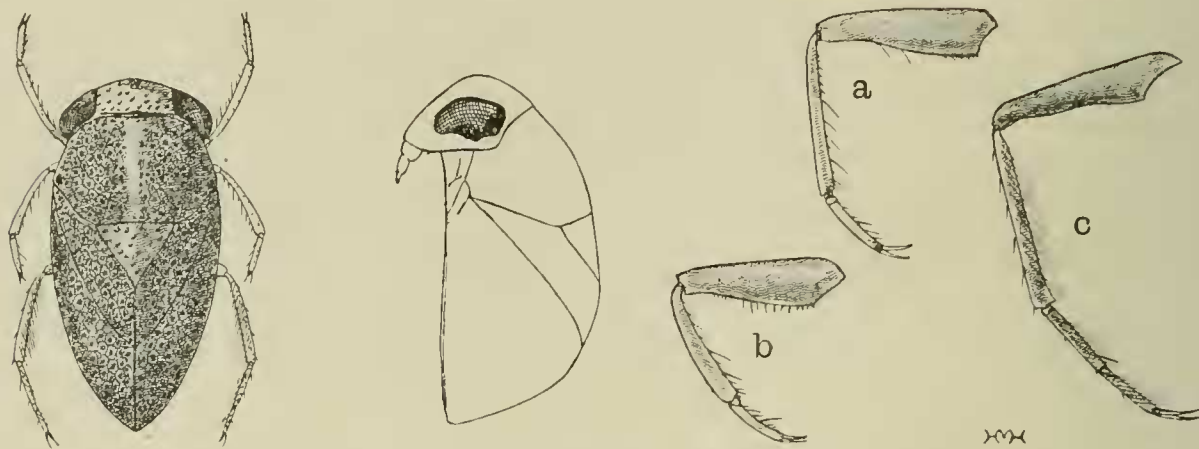


Fig. 371. *Plea brunni*; a, b and c, anterior, intermediate and posterior legs.

The examples from which the above description is made are provisionally referred to Kirkaldy's species; they agree well with the original description, excepting in the proportions of the intermediate legs. Kirkaldy writes: "Mittelschienen ein drittel langer als die Tarsen, erstes Tarsalsegment ein drittel langer als das zwiete."

These proportions apply to the *posterior* legs of the specimens before me, so, in preference to risking the creation of useless synonymy, I have regarded these limbs as the ones from which Kirkaldy's measurements were taken.

In the accompanying illustration of the insect, as seen from above, it will be noted that the pronotum, owing to its forward inclination, is foreshortened; its length can be more accurately gauged by a reference to the profile view.

A careful search for members of this genus in South Australia has resulted in the capture of the above species in two localities.

FAMILY CORIXIDAE.

(This publication, ii, 1922, p. 309.)

In addition to the asymmetrical abdomen, three other male characters are developed in several Corixid genera; these are the facial impression, the palal stridulatory comb, and the strigil, all of which are utilized during copulation, which is conducted underwater. Hungerford remarks that when *Arctocorisa* is *in copula*, "The pegs of the male palae make the embrace more secure, while the

peculiar structure called the strigil, upon the right side of the abdomen, without doubt serves a similar purpose." (5)

The accompanying drawing (fig. 372) shows the apparent function of the large facial impression of *Arctocoris truncatipala* during copulation; the male clasps the female with the short front legs, while the head is bent down so that the foveate face is closely applied to the rounded back of his consort, thus doubtless affording additional assistance in maintaining his position; a bubble of air is trapped in the space between the head and the prothorax.

POROCORIXA HIRTIFRONS Hale.

Included in a batch of Corixids recently collected by Mr. F. W. Shepherd at Broken Hill, New South Wales, is a good series of *Porocorixa hirtifrons*, previously known only from a few more or less damaged specimens; this locality is, therefore, to be added to the known distribution of the species.

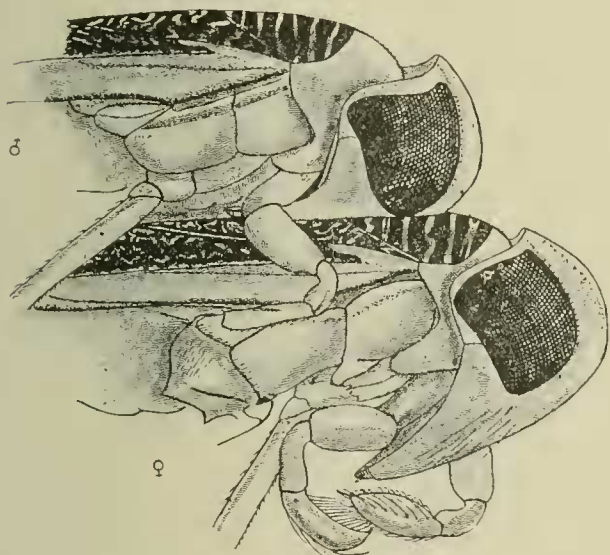


Fig. 372. *Arctocoris truncatipala* in copula.

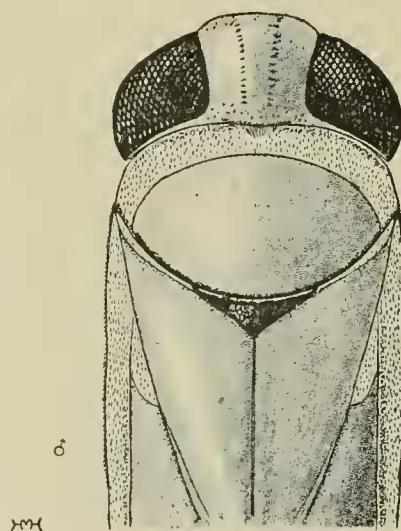


Fig. 373. *Porocorixa hirtifrons*.

The following additional notes are from these fresh examples.

Head pale ochraceous. The sub-elliptical, slightly raised area of the pronotum pale olivaceous-brown, not extending to the lateral edges; the anterior portion, including a broad lateral margin on each side, pale ochraceous; posterior edge very narrowly margined with brownish-black. Posterior angle of scutellum exposed, dull, black. Pegs of male palae twenty-three to twenty-seven. Under-side grey, fading to ochraceous after drying.

(5) Bull. Univ. Kansas, xxi, 1919, p. 229.

From an examination of these undamaged examples it is evident that the head cannot entirely overlap the anterior pale portion of the pronotum; the actual condition is shown in fig. 373.

EXPLANATION OF PLATES.

Plate x.

- Fig. 1. *Enithares bergrothi* clinging to plant stem.
 Fig. 2. *Anisops hyperion*, with guard hairs spread at surface.
 Fig. 3. Eggs of *Anisops hyperion* partially inserted in leaf of *Vallisneria spiralis*; note the slits denoting abortive attempts to insert the ova in the thin tissue.
 Fig. 4. Two of the eggs further enlarged; note the eyes of the developing embryo.
 Fig. 5. Eggs of a Corixid (*Porocorixa curynome?*), for comparison.

Plate xi.

- Fig. 1 to 10. *Anisops hyperion*.
 Fig. 1. Eggs *in situ* in *Potamogeton* stem; note the exposed portion.
 Fig. 2. Egg, showing developing eye-pigment, etc.
 Fig. 3 to 7. Dorsal and (a) ventral views of the five nymphal instars; the actual size from first instar nymph to imago is shown at (b).
 Fig. 8. Ventral view of adult female.
 Fig. 9. Intermediate leg of fifth instar nymph, showing the developing imaginal leg as seen through integument; note the two-jointed tarsus within the monomerous tarsus.
 Fig. 10. The left member of the pair of gouging gonapophyses of the ovipositor: fig. 10a shows the tip of the organ further enlarged.
 Fig. 11. Left gouging gonapophysis of *Anisops doris*.
 Fig. 12. " " " " " *gratus*.
 Fig. 13. " " " " " *stali*.
 Fig. 14. " " " " " *calcaratus*.
 Fig. 15. " " " " " *feberi*.